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Can different positions facilitate block application in ultrasound-guided obturator nerve block? A prospective comparative study

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ABSTRACT

Objective: We aimed to compare the distances of the landmarks to the skin, image quality, and ease of application in the ultrasound-guided obturator nerve block (ONB) in different positions.

Materials and Methods: 40 volunteers aged between 20-65 years were included in the study. The distances of the landmarks (anterior and posterior branches of the obturator nerve; junction of the abductor longus and abductor brevis muscles with the pectineus muscle) to the skin, which were taken as a reference for the ultrasound-guided obturator block, were measured and compared in 3 different positions (P1=Neutral position; P2=45° Abduction; and P3=Flexed knee) given to the leg. We also evaluated the quality of the ultrasound image and the ease of application in each measurement by assigning a subjective observer score and comparisons were made for three positions.

Results: While the mean of the distances of the landmarks to the skin were the shortest in P3 and the longest in P1 position, there was no significant difference between the groups ($p>0.05$). A statistically significant difference was observed between P1 and P3 in the distance of the junction of the muscles to the skin surface ($p<0.05$). The highest score for the clarity of ultrasound images and ease of accessing the measurement points was the P3 position ($p=0.00$). In addition, in our correlation analysis, we found that as the distance of the landmarks to the skin surface decreased, the image clarity and the ease of access to the obturator nerve (score) increased, where $p<0.05$.

Conclusions: In ultrasound guided ONB, in P3 position landmarks get closer to the skin, and image clarity and ease of detection for landmarks increases in parallel with this position. As a result, the ultrasound guided ONB can be best done by giving flexed knee position.

Keywords: peripheral nerve block, obturator nerve, ultrasound

INTRODUCTION

The obturator nerve, which consists of the anterior branches of the second, third, and fourth lumbar nerves (L2-4), is a member of the lumbar plexus [1, 2]. In women, it is separated from the ovaries by a thin layer of peritoneum. It extends laterally along the pelvic wall into the obturator foramen and then through the obturator canal to the thigh and enters the pelvis from the medial edge of the psoas major muscle, passes through the obturator foramen and divides into the anterior branch between the adductor longus and brevis muscles on the inner surface of the thigh, and the posterior branch between the adductor brevis and magnus muscles.

The posterior branch also gives a branch to the knee joint [2-4]. Although the obturator nerve has two branches, both branches contain fibers for motor innervation, but only the anterior branch has fibers responsible for sensory innervation of the skin [5]. The anterior branch contains nerve fibers that provide dorsal innervation of the hip joint and mid-thigh, as well as motor innervation of the superficial adductor muscles. The posterior branch has fibers that provide motor innervation to the deep adductor muscles and sense the posterior aspect of the knee join. Although its sensory innervation can be very different, it is known that it innervates a small area on the inner surface of the knee [5].

Obturator nerve block (ONB) is widely used to prevent contractions and sudden movements of thigh adductor muscles during transurethral resection operations of bladder tumor and to relieve adductor muscle spasms in patients with spasticity, to treat chronic hip pain and to improve persistent hip adductor spasticity in patients with paraplegia, for postoperative analgesia in femoral operations, to provide optimal analgesia for patients and to treat pain after hip and knee surgery [6-8].

The aim of the study was to evaluate the optimum position to access the obturator nerve for the ultrasound guided ONB.

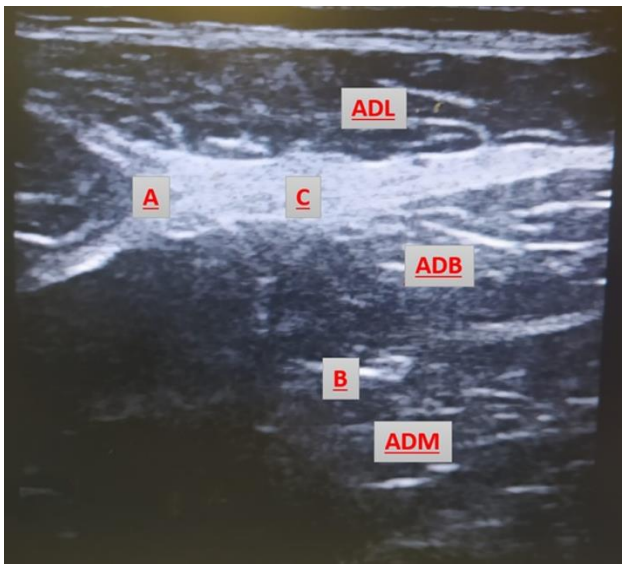

Figure 1. Landmarks and anatomical structures in ultrasound imaging (A: Junction of the pectineus muscle with the adductor longus and adductor brevis muscles; B: Obturator anterior nerve; C: Obturator posterior nerve; ADL: Adductor longus muscle; ADB: Adductor brevis muscle; and ADM: Adductor magnus muscle) (Images was reprinted with permission of the participants)

MATERIALS AND METHODS

We designed this study as a volunteer-based prospective cross-over study. After the approval of the ethics committee (Harran University Clinical Studies Ethics Committee (Date: 27.01.2020; Session No:02; Decision No. HRU/20.02.13), a total of 40 volunteers aged between 20-65 years who agreed to participate in the study were included in the study. Those who have a history of surgical operation, trauma, or infection in the lower inguinal region to be examined with an ultrasound probe, and volunteers with a body mass index (BMI)>30 were excluded from the study. After passing the femoral artery, femoral vein, and nerve bundle from the lower inguinal region with the linear probe of ultrasound (Esaote MyLab 30 Gold, linear probe, 10-18 MHz, Florence, Italy), the junction of the pectineus muscle and the abductor brevis abductor longus muscles (medial), obturator anterior (inferior), and obturator posterior (middle) nerve branches were determined and the distances of each these landmarks to the skin were measured separately (**Figure 1**).

All measurements were repeated at three different positions. **P1-Neutral position** (both lower limbs stretched parallel to the vertical axis of the body on supine position), **P2-45° Abduction** (left lower limb stretched parallel to trunk vertical axis, right lower limb abducted 45 degrees laterally body on supine position (right lower limb abducted 45 degrees), and **P3-Flexed knee** (left lower limb stretched parallel to the vertical axis of the body. In the right lower limb, the knee was flexed perpendicular to the left lower limb, and the right thigh was abducted and internally rotated in accordance with the flexion of the knee on supine position) (**Figure 2**).

Ultrasound imaging was performed in the right leg in all volunteers. After the desired images were obtained, the images were frozen and recorded. The distances of three landmarks to the skin in each three positions were recorded by distance

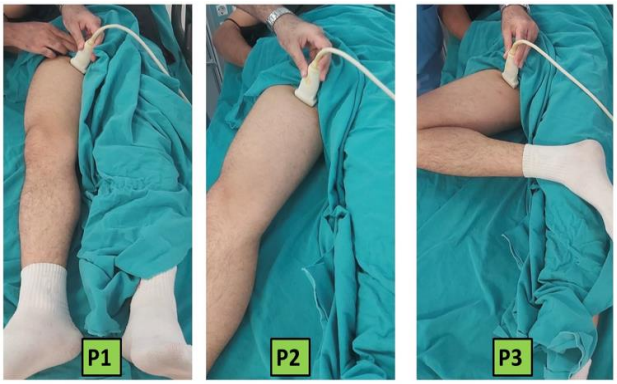

Figure 2. Different positions given to the leg for ONB and placement of ultrasound probe (Images were reprinted with permission of the participants)

measurement on ultrasound. Measurements were made by an anesthesiologist experienced in regional anesthesia. The measuring specialist was asked to evaluate the ultrasound image according to the clarity of the ultrasound image and the easy detection of the landmarks, assessing a score between 1 and 5 (1: very bad, 2: bad, 3: average, 4: good, and 5: very good); scores were recorded and compared for each position.

Statistical Methods

SPSS (statistical package for the social sciences) version 20.0 was performed for the descriptive statistical values of the obtained data and for all other statistical analyzes. One-way ANOVA test was applied to make comparisons between groups. Bonferroni test was used for post-hoc analysis of homogeneously distributed variances. Pearson correlation analysis was performed to evaluate the relationship between the score value and the distances. The significance criterion for all statistical analyzes was set as $p<0.05$.

Ethical Approval

Ethical approval was obtained from Harran University Clinical Studies Ethics Committee (Date: 27.01.2020; Session No:02; Decision No. HRU/20.02.13).

RESULTS

40 male volunteers with an average age of 26.62±7.60 (18-51) years, 172.75±6.58 cm (155-184) height average and 71.72±8.22 kg (51-85) weight average were included in the study.

The descriptive statistics for defining the distances of the anterior branch, a posterior branch of the obturator nerve, and joint of muscles to the skin surface, taken in different positions (P1=Neutral position, P2=45^0 Abduction, P3=Flexed knee) were given in **Table 1**. Among all three different positions, it was determined that the distances of the anterior branch of the obturator nerve, the posterior branch of the obturator nerve, and junction of the pectineus muscle with the abductor longus and the abductor brevis to the skin surface were at the closest distance in the P3 position.

According to the results obtained, it was determined that the average of the distances from the landmarks to the skin was the longest in the P1 position. Although these distances were shorter in the P2 position and P3 position, respectively, they were not statistically significant in distances of anterior and

Table 1. The descriptive statistics for defining the distances of anterior branch of the obturator nerve, the posterior branch of the obturator nerve and junction of the muscle to the skin surface, taken in different positions

Parameter	Position	Mean±SD (mm)	p-value (ANOVA)	p-value (Bonferroni)	
Distance from the anterior branch of obturator nerve to the skin	P1	22.02±6.74	0.469	P1-P2	1.000
	P2	21.30±6.67		P2-P3	1.000
	P3	20.21±6.64		P3-P1	0.670
Distance from the posterior branch of obturator nerve to the skin	P1	31.19±5.82	0.141	P1-P2	1.000
	P2	30.59±6.61		P2-P3	0.440
	P3	28.60±5.71		P3-P1	0.180
Distance from the junction of the pectineus muscle with the abductor longus and the abductor brevis to the skin	P1	23.34±4.61	**0.018**	P1-P2	0.640
	P2	22.20±3.97		P2-P3	0.320
	P3	20.71±3.62		P3-P1	**0.014**

Note. SD: Standard deviation; P1: Neutral position; P2: 45° Abduction; P3: Flexed knee; & mm: millimeter

Table 2. The descriptive statistics of the score of the clarity of the ultrasound image and the ease of detection for landmarks

Position	Min.	Max.	Mean±SD	p-value (ANOVA)	p-value (Bonferroni)	
P1: Neutral position	1	3	1.65 ± 0.73	**0.00**	P1-P2	**0.00**
P2: 45^0 Abduction	1	5	2.92 ± 0.94		P2-P3	**0.00**
P3: Flexed knee	3	5	4.27 ± 0.64		P3-P1	**0.00**

Table 3. The results of the Pearson correlation analysis applied to evaluate the relationship between the score and the distances of the landmarks to the skin surface

		A-S	P-S	M-S
Score	Pearson correlation	-.313*	-.243*	-.567*
	p	.000	.007	.000

Note. A-S: The distance between the anterior branch of the obturator nerve and skin surface; P-S: The distance between the posterior branch of the obturator nerve and skin surface; M-S: The distance between the joint of muscles and skin surface; & *Statistically significant for correlation analyses

posterior branch of obturator nerve to skin (p>0.05), but significant in distance from joint of muscles to skin (p=0.018).

According to the results of the bonferroni post-hoc test, a statistically significant difference was observed between P1 and P3 in the distance of the junction of the muscles to the skin surface (p=0.014).

The descriptive statistics of the score of the clarity of the ultrasound image and the easy detection of the measurement points were given in **Table 2**. According to the score results obtained, it was determined that the position with the highest score for the clarity of ultrasound images and accessing the measurement points was the P3 position (p=0.00).

According to the results of the Pearson correlation analysis applied to evaluate the relationship between the score and the distances of the anterior branch of the obturator nerve (A-S), the posterior branch of the obturator nerve (P-S), and muscle to the skin surface (M-S), a negative correlation was found between the scoring and the distances (p<0.005). It was observed that as the distance of landmarks to the skin surface decreased image clarity and ease of access to the obturator nerve (score) increased (**Table 3**).

DISCUSSION

Peripheral nerve blocks are cost-effective anesthetic techniques that are preferred to avoid undesirable conditions and hemodynamic complications encountered during airway management of general anesthesia. Patient satisfaction, increasing demand for cost-effective anesthesia, and rapid postoperative recovery have led to an increased demand for regional techniques [9, 10]. Recently, with the widespread use of ultrasound in regional anesthesia, the safety and effectiveness of block have increased. With the real-time visualization of the needle and the increase in image quality over time thanks to ultrasound during peripheral blocks, the procedures have been easier, and the complications have decreased. The most important factors hindering the success of peripheral nerve blockade are the difficulty of finding the "perfect point" and the inability to clearly determine the landmarks in nerve localization. To obtain the most appropriate ultrasound image, especially in the blockage of nerves that are difficult to reach and located deep, various positions are given to the patients [9-12].

The selective ONB was first described in [13] using the classic landmarks near the pubic tubercle and it was stated that ONB could be used to prevent obturator reflex and spasm in bladder surgery [14]. It was described the interadductor technique based on anatomical points for ONB added to spinal anesthesia [15]. Ultrasound (US) guidance increases the success of the block by allowing the branches of the obturator nerve to be visualized between the adductor muscles. In recent years, different approaches to ONB have emerged including the US-guided interfascial injection [6, 8, 16, 17].

In all reported proximal approaches for ultrasound guided ONB, the plane between the pectineus and obturator externus muscles is targeted as the local anesthetic injection site. Patient positions such as supine and lithotomy can be given, and ultrasound probe can be used with out-of-plane or in-plane technique [3, 18]. With the in-plane technique in the proximal approach of the ultrasound-guided ONB; the anterior branch is blocked between the pectineus muscle and adductor brevis muscles, and the posterior branch is blocked between the adductor brevis and adductor magnus muscles [3, 8, 18].

Since this technique is mostly preferred by the practitioners, we planned our study by giving different positions to the legs and knees of the volunteers with the proximal approach at the supine position in the in-plane method. When applying ultrasound guided ONB, different abduction angles and different angles of the knee area can be given to the leg to increase visibility, facilitate needle manipulation, increase visibility with ultrasound, and apply the block faster [8]. There is not enough information in the studies about which angle should be given to the leg and knee. To our

knowledge, this is the first study compered these three positions for ONB.

In our study, the distances of the obturator anterior, obturator posterior and pectineus muscle regions to the skin were measured by giving different angles to the leg and knee. We found that the mean of the distances from the skin of all three landmarks was the lowest in the knee position and the highest in the neutral position. We found that the distance of the pectineus muscle region to the skin decreased statistically significantly as the neutral position was changed to abduction and knee flexion positions. The closeness of the targeted anatomical area to the skin during the block application with ultrasound facilitates access to the point where the block will be made, and the image is taken more easily with ultrasound. We think that the anatomical structures that are deeper in the neutral position become superficial with the applied positions, and this will provide the convenience of imaging, which is important for the success of the block. In addition, in our study, we found that the best score was in the knee flexion position, followed by abduction and neutral position, respectively, in the scoring of the practitioner's satisfaction in terms of ultrasound image clarity and easy detection of targeted anatomical structures. ($p<0.05$, **Table 1**). In the Pearson correlation analysis, we also found that the image quality and the satisfaction of the practitioner increase with the decrease in the distance to the skin, and that there is a strong correlation in this regard. Therefore, we think that it will be a simple sonographic technique that will increase the chance of success for ONB. Future clinical prospective randomized studies needed to prove its effect on the block success.

There are limitations of our study. We studied only male volunteers and women were omitted. Also, we included, only volunteers with a normal BMI, and only right lower limbs were studied. Better results can be obtained with groups of volunteers of different gender, age, and physical characteristics. We think that the data we obtained will be a reference for these studies.

CONCLUSION

According to the results we obtained, as the distance of the landmark points in ultrasound guided ONB to the skin decreases, the image clarity and access to the obturator nerve will be optimum. As a result, we conclude that the ultrasound guided ONB is best done by giving flexed knee position.

Author contributions: All authors have sufficiently contributed to the study and agreed with the results and conclusions.

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Ethical statement: Authors stated that ethical approval was obtained from Harran University Clinical Studies Ethics Committee (Date: 27.01.2020; Session No:02; Decision No. HRU/20.02.13). Informed consents were received from all participants before the study.

Declaration of interest: No conflict of interest is declared by authors.

Data sharing statement: Data supporting the findings and conclusions are available upon request from the corresponding author.

REFERENCES

1. Manassero A, Bossolasco M, Ugues S, Palmisano S, De Bonis U, Coletta G. Ultrasound-guided obturator nerve block: Interfascial injection versus a neurostimulation-assisted technique. Reg Anesth Pain Med. 2012;37(1):67-71. https://doi.org/10.1097/AAP.0b013e31823e77d5 PMid: 22157744
2. Jo SY, Chang JC, Bae HG, Oh JS, Heo J, Hwang JC. A morphometric study of the obturator nerve around the obturator foramen. J Korean Neurosurg Soc. 2016;59(3):282-6. https://doi.org/10.3340/jkns.2016.59.3.282 PMid:27226861 PMCid:PMC4877552
3. Anagnostopoulou S, Kostopanagiotou G, Paraskeuopoulos T, Chantzi C, Lolis E, Saranteas T. Anatomic variations of the obturator nerve in the inguinal region: Implications in conventional and ultrasound regional anesthesia techniques. Reg Anesth Pain Med. 2009;34(1):33-9. https://doi.org/10.1097/AAP.0b013e3181933b51 PMid: 19258986
4. Kati B, Izgi M. A nightmare during endoscopic bladder tumor resection; obturator reflex. J Turgut Ozal Med Cent. 2017;24(3):1. https://doi.org/10.5455/jtomc.2016.12.134
5. Bouaziz H, Vial F, Jochum D, et al. An evaluation of the cutaneous distribution after obturator nerve block. Anesth Analg. 2002;94(2):445-9. https://doi.org/10.1213/00000539-200202000-00041 PMid:11812716
6. Akkaya T, Comert A, Kendir S, et al. Detailed anatomy of accessory obturator nerve blockade. Minerva Anestesiol. 2008;74(4):119-22.
7. Sharma D, Singh VP, Agarwal N, Malhotra MK. Obturator nerve block in transurethral resection of bladder tumor: A comparative study by two techniques. Anesth Essays Res. 2017;11(1):101-4. https://doi.org/10.4103/0259-1162.184613 PMid:28298765 PMCid:PMC5341669
8. Yoshida T, Nakamoto T, Kamibayashi T. Ultrasound-guided obturator nerve block: A focused review on anatomy and updated techniques. Biomed Res Int. 2017;2017:7023750. https://doi.org/10.1155/2017/7023750 PMid:28280738 PMCid:PMC5322453
9. Valentin N, Lomholt B, Jensen JS, Hejgaard N, Kreiner S. Spinal or general anaesthesia for surgery of the fractured hip? A prospective study of moratality in 578 patients. Br J Anaesth. 1986;58(3):284-91. https://doi.org/10.1093/bja/58.3.284 PMid:3947489
10. Vorobeichik L, Brull R, Bowry R, Laffey JG, Abdallah FW. Should continuous rather than single-injection interscalene block be routinely offered for major shoulder surgery? A meta-analysis of the analgesic and side-effects profiles. Br J Anaesth. 2018;120(4):679-92. https://doi.org/10.1016/j.bja.2017.11.104 PMid:29576109
11. Gianesello L, Pavoni V, Burzio I, Boccaccini A. Respiratory effect of interscalene brachial plexus block vs combined infraclavicular plexus block with suprascapular nerve block for arthroscopic shoulder surgery. J Clin Anesth. 2018;44:117-8. https://doi.org/10.1016/j.jclinane.2017.11.029 PMid:29195098
12. Gadsden JC. The role of peripheral nerve stimulation in the era of ultrasound-guided regional anaesthesia. Anaesthesia. 2021;76:65-73. https://doi.org/10.1111/anae.15257 PMid:33426665
13. Labat G. Regional anesthesia; its technic and clinical application. WB Saunders; 1922.

14. Prentiss RJ, Harvey GW, Bethard WF, Boatwright DE, Pennington RD. Massive adductor muscle contraction in transurethral surgery: Cause and prevention; development of new electrical circuitry. J Urol. 1965;93(2):263-71. https://doi.org/10.1016/S0022-5347(17)63757-1
15. Wassef MR. Interadductor approach to obturator nerve blockade for spastic conditions of adductor thigh muscles. Reg Anesth Pain Med. 1993;18(1):13-7.
16. Akkaya T, Ozturk E, Comert A, et al. Ultrasound-guided obturator nerve block: A sonoanatomic study of a new methodologic approach. Anesth Analg. 2009;108(3):1037-41. https://doi.org/10.1213/ane.0b013e3181966f03 PMid: 19224822
17. Soong J, Schafhalter-Zoppoth I, Gray AT. Sonographic imaging of the obturator nerve for regional block. Reg Anesth Pain Med. 2007;32(2):146-51. https://doi.org/10.1097/00115550-200703000-00009 PMid:17350526
18. Taha AM. Brief reports: Ultrasound-guided obturator nerve block: A proximal interfascial technique. Anesth Analg. 2012;114(1):236-9. https://doi.org/10.1213/ANE.0b013e318237fb40 PMid:22025494